

Appendix 5

Greenhouse Gas Emissions

Proposal

Chapter 8 of the applicant's Environment Statement assesses, calculates and describes the potential greenhouse gas emissions (GHG) from the proposal. It does this by taking data about the project (e.g. quantity of gas burnt in the flares and vehicle movements) and applies factors that allow the GHG emissions from the project to be calculated.

The applicant states there is no methodology to determine the significance of the emissions associated with the project. However, although the significance cannot be assessed the applicant's assessment compares the greenhouse gas emissions from the project to UK national GHG emissions for 2012.

The assessment has used data provided by Cuadrilla from previous projects on the amount of fuel or energy used. Where this data was not available other sources of information have been used. Where this is the case, ranges have been applied where possible. In addition, more than one source of emission factors has been applied to provide a range of results. This makes allowance for uncertainties associated with the project.

The greatest source (73%) of the project GHG emissions come from burning the gas in the flare. The total project GHG emissions could be between 118,418 (lower range) to 124,397 (higher range) tCO_e (tonnes carbon dioxide equivalent).

Policy

The Climate Change Act, 2008

The Climate Change Act (2008) establishes a framework for the UK to achieve its long term goals of reducing greenhouse gas emissions (GHG) emissions by at least 80% from 1990 levels by 2050 and to ensure that steps are taken towards adapting to the impact of climate change.

An interim target of 34% reduction from 1990 by 2020 has also been agreed. Some of the key measures provided by the CCA include:

- Decarbonising the grid supply, such as renewable source of energy;
- Cleaner transport modes such as electric and hybrid vehicles;
- Energy efficiency measures in the built environment; and
- Behavioural changes.

The Carbon Plan, 2011

The Carbon Plan sets out the Government's plans for achieving the GHG emissions reductions committed to in the Climate Change Act and the first four carbon budgets. The strategy for energy as set out in the Carbon Plan includes:

- Reduce emissions from electricity generation through increasing the use of gas instead of coal, and more generation from renewable sources;

- Support the deployment of major low carbon technologies through providing financial incentives; and
- Support the development of less mature renewable technologies such as marine and offshore technologies.

National planning policy

National Planning Practice Guidance (PPG) states that planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure

Paragraph 98 of the PPG states:

When determining planning applications, local planning authorities should:

- *not require applicants for energy development to demonstrate the overall need for renewable or low carbon energy and also recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and*
- *approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should also expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.*

Lancashire Climate Change Strategy, 2009

The Lancashire Climate Change Strategy sets out the county's long-term objective to achieve a 'low carbon and well adapted Lancashire by 2020'.

The strategy contains an objective to actively promote decentralised energy production and medium and large scale renewable energy generation. The strategy recognises the challenge is to ensure that the replacement energy supply for fossil fuels will be low carbon.

Joint Lancashire Minerals and Waste Local Plan

Policy DM2 of the JLMWLP states that development for minerals operations will be supported where it can be demonstrated that all material social, economic or environmental impacts that would cause demonstrable harm can be eliminated or reduced to acceptable levels. In assessing proposals account will be taken of the proposal's setting, baseline environmental conditions and neighbouring land uses, together with the extent to which its impacts can be controlled in accordance with current best practice and recognised standards.

Consultees and representations

Medlar-with-Wesham Parish Council and Kirkham Town Council: Object to the proposal. Air pollution from gas emissions. Flaring can lead to over 250 pollutants including methane.

Roseacre, Wharles and Treales Parish Council: Objects to the proposal: On greenhouse gas emissions:

- Contrary to Policy EP26 and CS5 as the flare will emit 15,000 tonnes of methane and there is no mitigation for the health hazards of particulate matter
- Contrary to NPPF as it will not support a low carbon future.

Friends of the Earth: have made two representations. The following views relate directly to greenhouse gas emissions:

- The assessment of the potential for greenhouse gas (GHG) emissions is incorrect, with regard to impact of leakage, global warming potential (GWP) of methane and scales of emissions.
- The EIA findings that the impact on climate change is n/a does not enable the local planning authority to make an informed decision.
- The mitigation measures proposed for possible sources of fugitive methane emissions are basic and may be ineffective based on US research.
- The figure used in the application for GWP is inaccurate and asks for clarity regarding the carbon footprint calculations.
- The comparison of the sites GHG emissions to the UK carbon budget is wholly inappropriate. Cuadrilla does not appear to know how much GHG will be emitted and therefore the precautionary principle should apply.
- Utilising shale gas resources is contrary to Policy DM2, to reduce carbon emissions and is contrary to the Lancashire Climate Change
- Planning decisions must take account of the need to reduce GHG emissions and this application will increase the emissions.
- the applicant has failed to properly consider climate change
- the applicant has not considered methane emissions from drilling
- fugitive methane emissions is a key issue because of its high global warming potential
- an incorrect conversion factor has been used for methane in respect of its potential to contribute to global warming, meaning the contribution of the proposal to greenhouse gas emissions would be nearly 3.5 times that stated by the applicant.
- Comparing the proposal's greenhouse gas emissions to the UK's emissions is inappropriate. The comparison should be more local.
- The County Council, as mineral planning authority, has a duty to reduce and mitigate the impact of climate change.
- The report by the previous government Chief Scientist into the 'Potential Greenhouse Gas Emissions Associated with Shale Gas Extraction and Use' is contested.

Roseacre Awareness Group (RAG): Objections related to climate change:

- Investment in shale gas diverts resources from cost effective, less damaging renewable energy solutions – tidal, wind and solar.
- Contrary to Lancashire Climate Change Policy and Climate Change Act as use of fossil fuels not meet low carbon objectives. Shale gas methane emissions are more detrimental than from coal.

Wildfowl & Wetlands Trust (WWT): Objection includes a greenhouse gas concern on the basis that fossil fuel contributing to climate change, a serious long term threat to the natural environment and to economic and social wellbeing.

RSPB: Objection includes a greenhouse gas concern on the basis that hydraulic fracturing which could lead to long-term damage to nature at the local level, leading to significant financial costs for local communities and taxpayer as well as contributing to climate change, which is the most serious long-term threat to the natural environment.

Other representations

The following is a summary of the points raised in representations that mention greenhouse gas emissions and climate change:

- Extraction of shale gas will further add to the burning of fossil fuels and exacerbate climate change
- Immoral to pollute the environment by increased use of carbon-based fuels
- Shale production will have a negative effect on meeting UK targets relating to global heat, carbon emissions and greenhouse gas emissions, from Kyoto agreement and Climate Change Act 2008
- Contrary to NPPF Para 93 reductions in greenhouse gas emissions
- LCC has a responsibility to help reduce emissions
- LCC Moral duty to ensure fossil fuels not exploited
- Need to leave fossil fuels in the ground
- International Energy Agency warn that most of gas should stay in ground to avoid catastrophic climate change
- The use and burning of fossil fuels impacts on climate change
- Burning shale gas is as bad as burning coal.
- Can't continue to use up natural resources

Assessment

Many of the representations made against this application refer to the wider national impact on greenhouse gas emissions as a result of the use of gas. Many representations make an assumption that the shale gas industry will scale-up substantially and will damage the UK's efforts to tackle climate change.

However, this application is for four experimental boreholes. Any proposal to move into gas production will be the subject of a new planning application. The impacts of

this application must therefore be assessed against the greenhouse gas emissions from the project for four exploratory wells only.

Nevertheless, given the level of representations on this issue (greenhouse gas emissions associated with the wider shale gas sector) it is appropriate that the issues are explored briefly.

Emissions from the shale gas sector

The House of Commons Energy and Climate Change Committee reported on the 'The Impact of Shale Gas on Energy Markets' in 2013. The Committee concluded that the US shale gas revolution has seen significant reduction in the country's greenhouse gas emissions because of a large switch from coal to gas. And a report by DECC's Chief Scientific Advisor in 2013 concludes that shale gas's overall carbon footprint was comparable to gas extracted from conventional sources, lower than that of liquid natural gas and, when used for generating electricity, significantly lower than that of coal if the correct controls are used.

However, this study is contested by Friends of the Earth who cite several other pieces of research to show that methane leakage is significant and adds considerably to the carbon footprint of shale gas. (Friends of the Earth further argue there is a risk that shale gas will be used as well as coal rather than in its place. And it may divert investment from alternatives such as renewables, weakening the case for reducing the UK's reliance on fossil fuels).

In turn, the research into methane emissions cited by Friends of the Earth has been challenged. The House of Commons Energy and Climate Change Committee (2013) refer to research by the Massachusetts Institute of Technology which suggests the claims of substantial methane emissions have been exaggerated. Other more recent research has also been criticised because of methodological flaws (e.g. very small aerial sample size and the confounding effects of a coal mining area on methane emissions in the study). Methane emissions undoubtedly occur. But there are differing views on the degree and impact of emissions.

Given the lack of conclusive evidence either way, the carbon footprint of shale gas remains a source of disagreement, which was recognised by the House of Commons Energy and Climate Change Committee.

The Committee therefore recommended that *"DECC should also monitor the methane emissions of those companies that are currently exploring for shale gas. It should be possible, by way of regulation, to ensure that fugitive emissions are prevented by outlawing venting"*.

The Environment Agency draft permit regulates fugitive emissions of methane. Venting is not permitted except in safety emergencies. Condition 3.2 of the draft permit applies controls. Flowback fluid will be transferred through the separator and to the storage tanks via enclosed pipework. And as described in section 9.9 of the Waste Management Plan (which is part of the draft permit) pipework and connections will be tested for integrity prior to use and will be monitored during operations. Importantly, methane monitoring will take place before, during and after operations.

Global warming potential of methane

Global-warming potential (GWP) is a relative measure of how much heat a greenhouse gas traps in the atmosphere. It compares the amount of heat trapped by a certain mass of the gas in question to the amount of heat trapped by a similar mass of carbon dioxide.

Friends of the Earth (FOE) say that the figure used by the applicant in the ES for the global warming potential of methane is inaccurate. It is this figure which plays an important part in estimating the carbon footprint of the project, including its greenhouse gas emissions.

The applicant has used a figure of 25 over a 100 year timeframe, citing the UN Intergovernmental Panel on Climate Change (IPCC) fourth assessment report that uses this figure. FOE argues that the figure of 34 should be used from the recent IPCC fifth assessment report. They also argue that the GWP of methane over a 20 year period (as well as a 100 year period) should have been used.

The applicant says GWP figures were selected to provide consistency with DEFRA conversion factors which are currently based on the IPCC's 2nd assessment report. DEFRA's aim is to provide a consistent comparison with the UK Greenhouse Gas Inventory and Kyoto Protocol. The GWP of 25, over a 100-year period, maintains this consistency of comparison and incorporates a safety margin in the estimation of effects.

DECC's Chief Scientist says methane has a global warming potential 25 times greater than CO₂, based on a 100-year time horizon in his September 2013 report (citing the IPCC fourth report).

The UK Greenhouse Gas Inventory, 1990 to 2012: Annual Report for Submission under the Framework Convention on Climate Change (published April 2014 by DECC) uses a greenhouse gas potential figure of 21 over 100 years for methane (Table 1.1).

In light of the conversion factors commonly used by other agencies in the UK, the applicant's use of a figure of 25 is not unreasonable.

Emissions from this project

The applicant's ES estimates the greatest source of the project GHG emissions come from burning the gas in the flare (73%). The total project GHG emissions could be between 118,418 (lower range) to 124,397 (higher range) tCO_e (tonnes carbon dioxide equivalent).

Both direct and indirect GHG emissions have been assessed. Direct emissions are GHGs emitted directly by activities associated with the project, such as the combustion of fossil fuels by on-site generators or through the flares. Indirect emissions consist of GHGs emitted outside of the direct influence of the project (either further up or down the supply chain). For example, GHG emissions associated with the production, extraction, refining and transport of diesel used to power generators and trucks (referred to in this assessment as well-to-tank), or the treatment of flowback fluid are defined as indirect emissions. A more detailed summary of emission sources

associated with the project, and whether or not they are direct or indirect, is included in Table 8.2 of the ES.

The average volume of direct emissions is 114,009 tCO₂e. The average volume of indirect emissions is 7,401 tCO₂e.

The project's carbon footprint is 118,419 to 124,369 tCO₂e. This is made up of approximately 94% direct emissions and 6% indirect emissions. 73% of the project carbon footprint can be attributed to flaring.

Emissions from drilling

The issue of potential methane emissions from the drilling phase has been raised by Friends of the Earth. The Environment Agency draft permit requires that during drilling of the exploratory boreholes, fugitive emissions of natural gas are to be prevented by increasing the hydrostatic pressure of fluids so as to prevent gas release. The well will also be equipped with physical control equipment which enables the borehole to be shut at the surface to prevent escape of gas emissions. Gas monitoring equipment will be in constant use at the surface. The draft permit does not allow the venting of natural gas unless it-is-necessary for reasons.

Fugitive emissions of methane could potentially arise from the wellbore and mud circulation system. The applicant has provided a specific risk assessment for this scenario, which includes monitoring and proposes emergency control measures. The operator will carry out testing of all surface pipework to check for leaks prior to starting the operations and will be carrying out monitoring using Flame Ionization Detection monitoring equipment during the operations as part of the Environmental Management and Monitoring Plan required by the draft permit.

The operations will be benchmarked against baseline levels and should elevated levels of methane be detected, the well will be shut and the cause of the damages investigated and remedied. Operation will only resume once the Agency is satisfied that the issue has been resolved.

The Agency is satisfied that these measures minimise the risk of fugitive emissions and, together with condition 3.1 of the draft permit, provide acceptable controls.

Emissions from the flare

The principal greenhouse gas emitted is carbon dioxide (CO₂), but the flare could also emit small amounts of methane (CH₄) arising from the combustion process. The Environment Agency expect combustion efficiency of at least 98%, therefore there is potential for a small amount of un-burnt methane to be emitted from the flare (fully efficient combustion converts CH₄ to CO₂ and water vapour). CH₄ has a global warming potential many times that of CO₂.

The major source of greenhouse gas emissions from the installation is however CO₂ from the combustion of natural gas. The best available technique for greenhouse gas emissions is to maximise energy recovery and efficiency but on this occasion the Agency is satisfied that flaring the gas is the best available option.

The operator has justified the use of a flare rather than using the gas on site by demonstrating to the Agency that the costs of using the gas would be disproportionate for the 90 day periods. It is also not reasonably practicable to connect the flow of extracted natural gas to the gas grid during the initial flow tests. This is because the flow rates are unknown and the quality of the gas produced may not be compatible with gas grid requirements without further processing.

In addition, in order to establish whether there is sufficient flow of gas to move to extended flow testing, there needs to be an uninterrupted flow. Using the gas to meet energy requirements on site would necessitate interrupting the gas flow, preventing the collection of the required data for analysis.

The incineration of hazardous waste is not subject to the Greenhouse Gas Emissions Trading Scheme Regulations 2012; therefore it is a requirement of the Industrial Emissions Directive to investigate how emissions of greenhouse gases emitted from this activity might be prevented or minimised.

The only factor influencing the GWP of the installation is the efficient operation of the combustion unit. The operator will ensure the combustion of natural gas is carried out to the maximum efficiency; by monitoring the combustion temperature and air flow. Requirements to this effect are in the draft permit.

Comparative analysis

In attempt to determine whether the projects greenhouse gas emissions are significant, the applicant has compared the emissions expected from this project to the UK's greenhouse gas emissions in 2012. This concludes that the project is equivalent to 0.002% of the current UK Carbon Budget set by the government and as such the project's contribution to national GHG emissions is negligible.

There is no standard methodology to determine the significance of the emissions associated with the project. The applicant has therefore chosen to compare the project's emissions with the UK's emissions for 2012. Comparing the emissions of 4 exploratory boreholes with those of the UK as a whole is not the most appropriate comparison, and Friends of the Earth also make this point.

A more appropriate comparison would be against local emission data, for example those contained in the Lancashire Climate Change Strategy published in 2009. Total CO₂ emissions in Lancashire (as set out in the strategy) were estimated at 12.7 million tonnes. Maximum emissions from the project over its 5.5 years are estimated at 124,369 tonnes carbon dioxide equivalent (tCO₂e). This averages to 22,613 tCO₂e per year, which is 0.18% of the county's annual emissions as set out in the Strategy. The project's emissions are just over 3% of the Borough's annual emissions. The emissions are short term.

By way of further comparison, livestock is a significant source of methane emissions. Agriculture is the highest contributing sector to total methane emissions for the UK, representing 46% of total methane emissions. The Fylde contains about 14% of the cattle and pigs in Lancashire, which is higher than average. If 46% of all methane emissions in the Fylde are from livestock (as in the UK) then it would not be inappropriate to suggest that agriculture in the Fylde is a significant source of

greenhouse gas emissions in the Borough. Landfill gas sites can also be a significant source of methane emissions.

In light of these comparisons, together with the proposed regulation and operational practices to limit methane emissions, it is concluded that the greenhouse gas emissions would not cause an unacceptable impact.

Conclusion

The project will generate some greenhouse gas emissions. But providing the operational practices are adhered to and regulated by the Environment Agency, the emissions would not cause unacceptable impacts.

The Environment Agency draft permit requires that during drilling of the exploratory boreholes, fugitive emissions of natural gas are to be prevented by increasing the hydrostatic pressure of fluids so as to prevent gas release. The well will also be equipped with physical control equipment which enables the borehole to be shut at the surface to prevent escape of gas emissions. Gas monitoring equipment will be in constant use at the surface. The draft permit does not allow the venting of natural gas unless it-is-necessary for reasons. Comprehensive monitoring of the practices and the site, overseen and regulated by the Environment Agency, will ensure that any risks are managed effectively.

The major source of greenhouse gas emissions from the proposal is however CO₂ from the combustion of natural gas in the flare. The operator has justified the use of a flare rather than using the gas on site by demonstrating to the Environment Agency that the costs of using the gas would be disproportionate for the 90 day periods. It is also not reasonably practicable to connect the flow of extracted natural gas to the gas grid during the initial flow tests. This is because the flow rates are unknown and the quality of the gas produced may not be compatible with gas grid requirements without further processing. In addition, in order to establish whether there is sufficient flow of gas to move to extended flow testing, there needs to be an uninterrupted flow. Using the gas to meet energy requirements on site would necessitate interrupting the gas flow, preventing the collection of the required data for analysis.

Total CO₂ emissions in Lancashire (as set out in the Lancashire Climate Change Strategy, 2009) were estimated at 12.7 million tonnes. Maximum emissions from the project over its 5.5 years are estimated at 124,369 tonnes carbon dioxide equivalent (tCO₂e). This averages to 22,613 tCO₂e per year, which is 0.18% of the county's annual emissions as set out in the Strategy. The project's emissions are just over 3% of the Borough's annual emissions. The emissions are short term.

The proposals would not be inconsistent with national planning policy or the policies of the development plan.